

Article by Alexander Graham Bell, undated

MAKING A TALKING MACHINE.

In my boyhood, at the suggestion of my father x see foot-note on p. 1½ , I attempted the construction of an automaton Speaking-Machine modelled after the vocal organs.

My brother Melville and I attacked the problem together; and divided up the work between us. He undertook to make the lungs and throat of the apparatus while I made the tongue and mouth. I was not more than 15 years of age at the time, and may have been younger; while my brother was two years my senior.

Description of the apparatus

Melville succeeded in making an artificial larynx of tin and rubber; Indeed, he made quite a number of models differing slightly in construction. One of the simplest forms — though not the most successful, but which maybe taken as typical a type of the whole — consisted of a tin tube with a tin lid soldered over one end. In the center of the lid was a rectangular slot, perhaps an inch long, and a quarter of an inch wide. A sheet of rubber was then stretched over the lid and tied round the tube. Before he put the rubber on he made an incision in it about an inch long with a sharp pen knife; and the slit thus formed, came over the slot in the tin lid when the rubber was in position. Upon then blowing up through the tube the edges of the rubber slit were thrown into vibration producing a musical sound.

His improvments consisted in using two sheets of rubber with the adjoining edges close together; and in giving the end over which they were stretched a form that caused the sheets to be

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Foot-note to page 1 Foot note:—

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It may be possible that this suggestion originated from a visit which my father paid to Sir Charles Wheatstone for the purpose of examining his talking-machine, which was substantially a reproduction of the celebrated automation Speaking-machine constructed by Baron De Kempelen in the 18th century. I was present on the occasion; and Sir Charles showed us the machine, and operated it with his own hand, and I heard it pronounce, in a very mechanical manner a few simple words and sentences. Sir Charles also lent my father De Kempelen's work, "*Le Mécanisme de la Parole*" containing plates and full description of his apparatus. With the assistance of my father, I studied the work and became much interested in De Kempelen's machine. I am now inclined to think however that the interview with Sir Charles Wheatstone did not take place until long after the construction of my talking-machine. My machine was made in Edinburgh, whereas the interview undoubtedly took place in London. It is possible however that the interview preceded the construction of my machine for I spent a year in London with my grandfather when I was 14 years old, and my father visited London to take me home. The interview might have taken place then, and of course we would be full of the wonders of the speaking-machine upon our return to London—Edinburgh—which would account for my father's suggestion. If the interview did not take place then, it must have been years later, for I was not in London again until I was about 19 years old. I am inclined to think that the interview did not take place until long after the construction of my machine—but cannot be sure.

A. G. B.

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presented to one another at an angle, instead of both being in the same plane.

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He intended to connect this artificial larynx with the wind-chest of an organ: But I do not think this was ever done, as he found that he could produce his artificial voice by merely blowing through the tube.

I succeeded in making an artificial mouth and tongue.

I obtained a human skull, and made a mould of the palate from which I produced a gutta percha copy of the roof of the mouth with gutta percha teeth. A lower jaw of gutta percha was also made and placed in position with iron wire joints. An imitation of the back of the pharynx was added in gutta percha; and a gutta percha cavity above the palate represented the nasal cavities. This completed what maybe termed the bony parts of the machine.

The soft palate was formed by a thin bag of soft rubber stuffed with cotton batting supported an inferior by an interior frame-work of iron wire and gutta percha. This was hinged to the back of the hard palate and the iron wires of the frame-work were continued through the nasal cavity to form a handle which projected outside where it could be worked up and down by hand. When this handle was depressed the artificial soft palate was raised into contact with the back of the pharynx. When the handle was raised the soft palate was depressed, thus forming an aperture communicating with the nasal cavity.

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The tongue was built in sections of wood, each section being connected with a straight handle , which projected below to enable each the sections to be separately raised or lowered as desired. There were six or seven sections in all. One , representing the point of the tongue , was narrower than the others, so that when pressed into contact with the upper part of the mouth, it would leave two side apertures for the escape of air, in the expectation that this would produce the sound of the letter L. The next section represented the part of the tongue immediately behind the tip. It was made somewhat convex ed on the top , and whe n pushed up into the mouth it made contact with the upper teeth on either

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side leaving a central aperture between the top of the section and the palate above. If further elevated it fitted snugly into the palate completely closing the passage-way. The other sections were of similar construction, and represented slices of the tongue, successively further and further back in the mouth. The last section of all represented the back part of the tongue. These movable sections were covered on top with a fair layer of cotton batting, to form soft cushions, like the covering of the hammers in a piano. Then a continuous sheet of rubber was stretched over the whole to form the upper surface of the tongue. Thus the tongue could be moved upwards at any point by pushing up the appropriate sections. As the section was raised the size of the aperture between it and the palate was gradually diminished; and at the highest point of elevation the tongue came into contact with the surface of the palate making complete closure of the mouth passage at that point.

Sheets of soft rubber formed the cheeks of the apparatus. Two lips were made of soft rubber bags, stuffed with cotton batting, on a frame-work of iron wire. They were hinged together and placed in front of the mouth.

(The lips of this machine still exist; and are preserved in the model museum attached to the Volta Laboratory in Washington, D. C.)

I had intended to connect all the movable parts to a key board, like a piano, but the construction never reached that stage.

Experiments with the talking machine

It was a great day when my brother's tin larynx was attached to the apparatus. Upon blowing through it a musical sound was produced resembling the human voice to a ludicrous extent, having vowel quality as well as pitch. It sounded like a punch and Judy show; whereas, without my apparatus, the effect resembled the sound of a tin horn used to celebrate the fourth of July.

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Helped no doubt by our imagination we thought the apparatus produced a very good “Ah”.

While my brother blew continuously through the larynx, I opened and closed the artificial lips with my hand. To our great delight the machine gave utterance , unmistakably , to the words — mamma, mamma, mamma.

We were not so successful with lingual elements. The vowel quality changed when the lingual sections were moved; and we were able to produce approximations to quite a number of the 5 consonants.

At this time it should be remembered we were only mere boys; and I am afraid that we were more interested in surprising our friends with strange effects, than with obtaining scientific accuracy in the production of speech sounds.

I remember that on one occasion we took the apparatus into the common stair-way of the house in which we lived — number 13 South Charlotte Street, Edinburgh — and caused it to articulate the words mamma, mamma, in as loud a tone of voice as we could command. My brother blew for all he was worth, while I worked the lips. A most agonising effect was produced. It really sounded like a baby in great distress; and at last some of the people living in the flats connected with the common stair opened the iron doors to see what was the matter. “Mamma, Mamma” came forth with heart-rending heart-rending effects .

We heard someone above say “Good gracious what can be the matter with that baby”, and then foot-steps were heard descending the stairs. This of course was just what we wanted. We quietly slipped into our house, and closed the door ; leaving our neighbors undisturbed to pursue their fruitless quest for the baby. Our trimp triumph and happiness were complete.

The talking machine w/ educational Educational use of the apparatus

I have gone at some length into the remembered details of this apparatus , with teh the object of showing that it was real work in which we were engaged , and not mere play. Persistent effort , and continuous labor for a long period of time , were necessary in order to accomplish even the slight results we obtained.

Mere boys are hardly capable of this sustained effort wi th out help from older persons; and I can realize now , that we never could have accomplished what we did, but for the guiding hand of my father, and with the stimul o us stimulus and encouragement of his presence.

The making of this talking-machine was a part of the his education of his boys. Our aim was one thing, his another. We simply aimed to produce a machine that would surprise our friends by articulating words. His aim was higher and nobler, for he used the talking -machine to familiarize his boys with the mechanism of speech, and the functions of the vocal organs. Many times were we discouraged and disheartened over our efforts and ready to give e the whole thing up in disgust. My father inculcated into us the importance of perse r verance and sustained effort in spite of defeat. He encouraged us with advise and practical suggestions. He stimulated us with a , the hope of a prize; and throughout the whole course of our experiments he utilized the machine to make us familiar with the details of his our professional work.

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In my first experiments I sought to utilize a human skull as a part of the apparatus, but soon gave this up in favor of a gutta percha model of the skull. It was my original intention to make a cranium of gutta percha, crown it with a wig, give it a face with eyes and nose, and indeed make it a complete copy of a human head.

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It was my father's guiding hand that restrained me from copying unnecessary parts, and substituting led me to substitutes, for the nasal passages, a resonance chamber of gutta percha that bore no resemblance at all to a human nose. In the final apparatus There was no cranium, no eyes, and nothing to suggest a human head excepting the teeth. I can well remember the queer grin of the gutta percha teeth, before the cheeks and lips were added.

The making of this talking-machine certainly marked an important point in my career. It made me familiar with the functions of the vocal organ; paved the way for success in teaching speech to the deaf; and started me along the path that led to the telephone.

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P.S. Portions of the Anecdote “Making a Talking Machine” — not given in forgoing pages From the Original Dictation preserved at the request of M.G.B. Original Dictation

Payed x x x x Paid a visit to Sir Charles Wheatstone for the purpose of examining his automation speaking-machine, which was substantially a reproduction of the celebrated automaton speaking-machine constructed by Barron Dekepelen Baron De Kempelen in the 18th century. Sir Charles showed us the machine and operated it with his own hands; and I heard it pronounce, in a very mechanical manner, a few simple words and sentences. Sir Charles also lent my father De Kempelen's Dekepemlen work “La Mecahnisme La Mécanisme de la parole” containing plates and full description of his apparatus

With the assistance of my father, I studied the work and became much interested in the artificial production of speech sound. Hypothesis not recollection AGB It seemed to me, I told my father, that it should be possible to construct a much more successful

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speaking- machine than that we had seen by directly copying the vocal organs themselves. My brother Melville agreed with me in this; and my father then suggested that we should try to make such a machine ourselves. He offered to pay for any material we needed and give us a big prize if we were successful. Even if we were not successful, he said, our experiments would rendered render us more familiar with the mechanism of speech.

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(From the original dictation)

My brothers Melville and I thereupon attempted to construct such a machine. Melville attacked the problem of the production of voice, while I took up the mouth and tongue, Melville constructed an artificial larynx in which the vocal chords were represented by two sheets of soft rubber, stretched across the top of the larynx. The adjoining edges of the sheets were brought closely together so that a mere slit existed between them. It was intended that the artificial larynx should be connected by a tube with an organ-chest to represent the lungs; but in our experiments we simply blew through the tube so as to set the rubber vocal chords in vibration. In this way Melville was able to produce an artificial voice — a musical tone having somewhat the characteristics of a beating reed.

I obtained a human skull and succeeded in making a mould of the mouth from which I produced a gutta percha copy of the roof of the mouth. A lower jaw of gutta percha was also made and placed in position. An imitation of the back of the pharynx in gutta percha completed what might be termed the bony part of the machine. Lips were made of soft rubber stuffed with cotton batting (the lips of this machine still exist and are preserved in the Museum of the Volta Laboratory in Washington, D. C.). *****

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(Omitted from second draft) (From the original Dictation)

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These sections were all movable from below and each one had a handle attached to it by which it could be pushed up towards the palate to any desired degree up to complete closure of the mouth passage by complete contact with the under surface of the palate. (O